# RMS Communication and Security Architecture

# Contents

Disclaimer ..... 1

**RMS Communication & Security Architecture** ..... 3

1. Security Architecture ..... 3
2. RMS Registration ..... 4
3. MQTT Topic Structure ..... 4
4. Communication Modes ..... 5
5. Communication Protocols ..... 5
6. MQTT Message Structure ..... 6

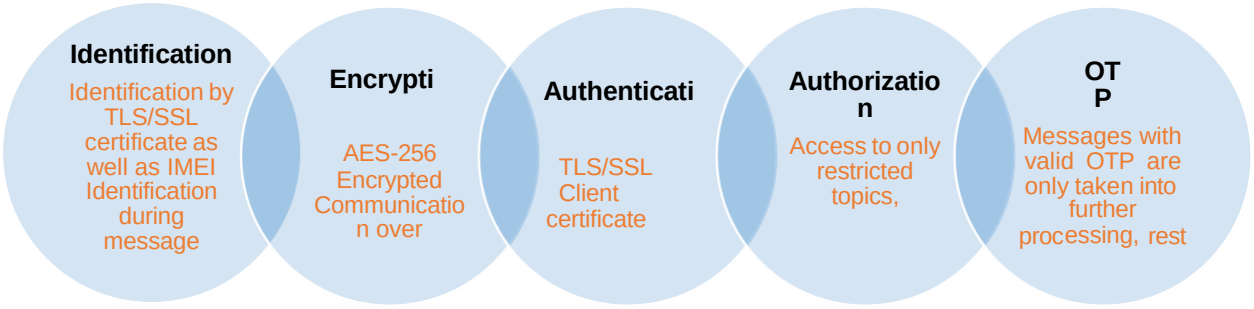
## RMS Communication & Security Architecture

1. Security Architecture (with reference to EESL Tender Annexure 8 – clause 4.d)
2. RMS Registration (with reference to EESL Tender Annexure 8 – clause 4.d)
3. MQTT Topic Structure (with reference to EESL Tender Annexure 8 – clause 4.b,4.c)
4. MQTT Message Structure (with reference to EESL Tender Annexure 8 – clause 4.e,4.f)
5. Annexure: JSON Formats with parameter keywords, sample values and description
    a. Annexure: Pump Controller
    b. Annexure: Energy Meter
    c. Annexure: Inverter
    d. Annexure: String Combiner Box (SJB)
    e. Annexure: Heartbeat
    f. Annexure: DAQ

### 1. Security Architecture

This section highlights the communication security architecture between RMS/DCU and State SWPS IoT Platform. With this security, architecture, third parties are unable to intercept or “sniff” the encrypted data. This stops ISPs, employers, local network administrators and cybercriminals from being able to perform “packet sniffing” to access what the traffic contains. It also protects against man in the middle (MitM) attacks. This implements Private TLS/SSL VPN to ensure highest level of security.

In additional to this, use of OTP in every message exchange shall help restrict spammers and Bots. Such OTP based mechanism will provide transaction level security which is required for remote operations.


Identification
Identification by TLS/SSL certificate as well as IMEI Identification during message
Encrypti
AES-256 Encrypted Communicatio n over
Authenticati
TLS/SSL Client certificate
Authorizatio n
Access to only restricted topics,
OT P
Messages with valid OTP are only taken into further processing, rest

## 2. RMS Registration

This section details how individual RMS/DCU shall be registered and communicate securely with State SWPS IoT Platform.

- Every supplier/vendor must Register all unique IMEI (International Mobile Equipment Identity) of RMS/DCU with State SWPS
- State SWPS will generate individual client certificate for RMS/DCU against unique IMEI registered and share with supplier/vendor through secured web API interface.
- Every supplier/vendor shall be able to access web API with unique credentials shared with them.
- Web API shall return individual client certificate, Device Broker url and "info" topic.
- After installation of client certificate relevant to IMEI of RMS/DCU, RMS/DCU will connect to Device Broker and get authenticated using client certificate and further shall be able to receive additional configuration details such as FTP credential, Message Topic structure etc. after subscribing to default topic.
- After client certificate expiry, RMS will connect to FTP using available credentials and download the renewed certificate

## 3. MQTT Topic Structure

This section defines the different topic structure for communication between RMS/DCU and State SWPS through Device Broker.

RMS/DCU will publish and subscribe to their respective topics only, authorization of topic shall be done against unique credentials.

| Application Version | Solution | IMEI | Message Type | Publish/Subscribe |
|---|---|---|---|---|
| **IIOT-1** | Standalonesolarpump | {IMEI} | Info | Subscribe |
| | Gridconnectedsolarpump | | OTP | Subscribe |
| | SolarMW | | Heartbeat | Publish |
| | Ongridrooftop | | Data | Publish |
| | Offgridrooftop | | Ondemand | Subscribe |
| | | | Config | Subscribe |

Sample Topic structure for Stand-alone Solar Pump shall be: **IIOT-1/Standalonesolarpump/{IMEI}/info**

**Multiple sub-topics will be formed for communication between RMS/DCU and sate SWPS IoT Platform**

- **Info:** Default Topic To exchange RMS/DCU configuration details
- **OTP:** To exchange OTP at every interval of 15/30/60 minutes
- **Heartbeat:** To update RMS/DCU health indicators at frequent configurable intervals.
- **Data:** To exchange data related to RMS/DCU Monitoring parameters in "**push mode**"
    - Push data Periodically
    - Push data on Event/Notification
    - History Missing Data Push Mode: History data will be identified against **"index"**

- **Ondemand:** To exchange data between RMS/DCU and Server in "**Command on Demand**" Mode
    - Each "On Demand" message will have two transactions: Commands, Response.
    - On demand command and response will be tracked against a common **"MSGID".**
    - On demand message can be used to read and write with two command types
        - Command: **"Read"** - In json received from server replace each key with value from RMS/DCU and send the updated json back to server.
        - Command: **"Write"** - After executing the command based on key-value pair received in json, send the updated json back to server on successful execution.
        - Note: handshaking parameters such as msgid, etc. has to send back to server as is, without modification
- **Config:** To update configurable parameters of Device, which is similar to Ondemand but will be used only for configurable parameters of Device, this implements "**Configuration over the air**"
        - Command: **"Read"** - In json received from server replace each key with value from RMS/DCU and send the updated json back to server.
        - Command: **"Write"** - After executing the command based on key-value pair received in json, send the updated json back to server on successful execution.
        - Note: handshaking parameters such as msgid, etc. has to send back to server as is, without modification

## 4. Communication Modes

- **Push on Periodic Interval:** In this mode deployed RMS shall transmit data of Multiple devices and sensors on different configurable time intervals such as Inverter or pump controller data at every 5 minutes, Energy Meter data at every 15 minutes, String Combiner Box data at every 10 minutes
- **Push on Event:** RMS shall detect various configurable alarm or event conditions such as Pump On / Off Status, Inverter On/Off Status, Low Water Flow Rate, Fault or Trip status etc. and It shall transmit data immediately to the server
- **On Demand Read:** In this mode, User will send command to RMS to get data as and when required and RMS will send the required data to server immediately
- **On Demand Write:** In case of Remote Operations, Farmer / Consumer shall send On Demand Write Command to the RMS and RMS will send back the acknowledgement with change in parameters after operation is completed
- **Configuration read/write:** Using this mode, user will be able to read and change configurable parameters remotely such as updating periodic interval, alarm limits, server parameters etc.

## 5. Communication Protocols

- **Field Device Communication:** RMS to Field Devices communication such as Inverter, Pump Controller, Drive, String Combiner box, MFT/MFM, Data Acquisition System shall be established using **MODBUS RTU protocol** supported by all leading manufacturers globally

- **Energy Meter Communication:** RMS to Energy Meter communication such as Bidirectional (Revenue) Meter, Solar Generation (Audit) Meter shall be established using **DLMS/Modbus protocol** supported by all leading meter manufacturers in India
- **RMS to Server Communication - Industrial IoT MQTT Protocol:** RMS to Server Communication shall be established using MQTT protocol which is well accepted IoT protocol across the globe and supported by all leading IT as well as OT companies for Smart Grid, Smart RE and Smart City Applications

## 6. MQTT Message Structure

This section details message structure exchanged between RMS/DCU and state SWPS IoT Platform through Device Broker

| keyword | Description | Sample Value |
|---|---|---|
| **IMEI** | Unique Identification of RMS/DCU – required to ensure registered source of data | 863287049443888 |
| **VD** | Virtual device/group – required for grouping parameters based on update interval/subsystems such as inverter/pump controller/meter/string combiner box etc. | 2 |
| **MSGID** | Message Transaction Id - required for “Ondemand”/”Config” message type, request/response/acknowledgement/feedback | 123456789 |
| **COMMAND** | Read/Write - Applicable only in case of “Ondemand”/”Config” message Type | Read |
| **TIMESTAMP** | RTC timestamp of RMS/DCU against all parameters of vd/group (YYYY-MM-DD HH:mm:SS) | 2019-08-20 20:15:08 |
| **STINTERVAL** | Periodic interval at which RMS shall store and transmit data to server. (in minutes) | 15 |
| **DATE** | local storage date – required as a reference to fetch data from local storage (YYYY-MM-DD) | 2020-06-15 |
| **INDEX** | Local storage Index – required as a reference to fetch data from local storage | 5 |
| **MAXINDEX** | Local storage maximum index of local storage date – required to calculate missing index | 96 |
| **LOAD** | Local storage retrieval command & status | 0 |
| **POTP** | Previous One Time Password | 12345678 |
| **COTP** | Current One Time Password, State SWPS Broker will update OTP at interval of 30/60 minutes | 12345678 |
| **Parameter-1**<br>**Parameter-2**<br>**Parameter-3**<br>**Parameter-1**<br>**……..**<br>**Parameter-n** | Equipment wise Keywords for multiple Parameters. | |

Communication Format Annexure

Annexure - 1 (Revision – B) Pump Controller

Message Name : Periodic Push Pump Controller (1)
Message Format : JSON
Message Type : Data
Message Command Flow : Not Applicable for Data periodic Push
Message response Flow : RMS -> State SWPS IoT Platform
Message Medium : GPRS

| Command Message | |
|---|---|
| | |
| **Not Applicable** | |

| Response Message | | |
|---|---|---|
| **Message** | **Description** | **Unit** |
| **{** | | |
| **"VD":1** | Virtual Device Index/Group | - |
| **"TIMESTAMP":"2020-05-18 17:58:00",** | RTC timestamp of RMS/DCU against all parameters of vd/group | - |
| **“MAXINDEX”:96** | maximum index of local storage date | - |
| **"INDEX":7,** | reference of local storage | - |
| **"LOAD":0,** | Local storage retrieval command & status | - |
| **"STINTERVAL":15,** | Periodic interval at which RMS shall store and transmit data to server. (in minutes) | - |
| **"MSGID":"",** | Message Transaction Id - required for “Ondemand”/”Config” message type, request/response/acknowledgement/feedback | - |
| **"DATE":200518,** | local storage date | YYMMDD |
| **"IMEI":"1234561234561234",** | IMEI No. of First Sim to be considered always for unique identity of DCU | - |
| **"ASN_11":"34123450",** | **Pump Controller Serial No.**<br>RMS: 0<br>DAQ: 1-9<br>Pump Controller: 11-19<br>Meter: 21-29<br>Inverter: 31-39<br>String Combiner Box: 41-49 | - |
| **"POTP":"341234",** | **Previous One Time Password** | - |
| **"COTP":"341234",** | **Current One Time Password** | - |
| **"PMAXFREQ1":"50.00",** | **Maximum Frequency** | Hz |
| **"PFREQLSP1":"50.00",** | **Lower Limit Frequency** | Hz |
| **"PFREQHSP1":"50.00",** | **Upper Limit Frequency** | Hz |

| | | | |
|---|---|---|---|
| **"PCNTRMODE1":"1",** | | **Solar Pump Controller Control Mode Status** | - |
| 0 | Variable Frequency Control Mode | | |
| 1 | CVT Mode for Solar | | |
| 2 | MPPT mode for Solar | | |
| **"PRUNST1":"2",** | | **Solar Pump Controller Run Status** | - |
| 0 | Stop | | |
| 1 | Running | | |
| 2 | Sleep | | |
| 3 | Low Speed Protection | | |
| 4 | Dry Run Protection | | |
| 5 | Over Current Protection | | |
| 6 | Minimum Power Protection | | |
| **"PREFFREQ1":"50.00",** | | **Solar Pump Controller Reference Frequency** | Hz |
| **"POPFREQ1":"50.00",** | | **Solar Pump Controller Output Frequency** | Hz |
| **"POPI1":"20.00",** | | **Output Current** | A |
| **"POPV1":"230.00",** | | **Output Voltage** | V |
| **"POPKW1":"45.00",** | | **Output Active Power** | KW |
| **"PDC1V1":"550.00",** | | **DC Input Voltage** | DC V |
| **"PDC1I1":"50.00",** | | **DC Current** | DC I |
| **"PDCVOC1":"650.00",** | | **DC Open Circuit Voltage** | DC V |
| **"PDKWH1":"35.00",** | | **Today Generated Energy** | KWH |
| **"PTOTKWH1":"120.00",** | | **Cumulative Generated Energy** | KWH |
| **"POPFLW1":"2",** | | **Flow Speed** | LPM |
| **"POPDWD1":"120",** | | **Daily Water Discharge** | Litres |
| **"POPTOTWD1":"220",** | | **Total Water Discharge** | Litres |
| **"PMAXDCV1":"750.00",** | | **Max DC Voltage** | DC V |
| **"PMAXDCI1":"40.00",** | | **Max DC Current** | DC I |
| **"PMAXKW1":"650.00",** | | **Max Output Active Power** | DC KW |
| **"PMAXFLW1":"650 ",** | | **Max Flow Speed** | LPM |
| **"PDHR1":"8.00",** | | **Pump Day Run Hours** | Hrs |
| **"PTOTHR1":"8.00",** | | **Pump Cumulative Run Hours** | Hrs |
| **}** | | | |
| | | | |

| **Reaction** | |
|---|---|
| | |
| **Not Applicable** | |

Communication Format Annexure

## Annexure - 2 Energy Meter

| | |
|---|---|
| Message Name | : Periodic Push Meter (1) |
| Message Format | : JSON |
| Message Type | : Data |
| Message Command Flow | : Not Applicable for Data periodic Push |
| Message response Flow | : RMS -> State SWPS IoT Platform |
| Message Medium | : GPRS |

| **Command Message** | |
|---|---|
| | |
| **Not Applicable** | |

| **Response Message** | |
|---|---|
| **Message** | **Description** |
| **{** | |
| **"VD":2** | Virtual Device Index/Group |
| **"TIMESTAMP":"2020-05-18 17:58:00",** | RTC timestamp of RMS/DCU against all parameters of vd/group |
| **“MAXINDEX”:96** | maximum index of local storage date |
| **"INDEX":7,** | reference of local storage |
| **"LOAD":0,** | Local storage retrieval command & status |
| **"STINTERVAL":15,** | Periodic interval at which RMS shall store and transmit data to server. (in minutes) |
| **"MSGID":"",** | Message Transaction Id - required for “Ondemand”/”Config” message type, request/response/acknowledgement/feedback |
| **"DATE":200518,** | local storage date |
| **"IMEI":"1234561234561234",** | IMEI No. of First Sim to be considered always for unique identity of DCU |
| **"ASN_21":12345678,** | Asset Serial Number<br>RMS: 0<br>DAQ: 1-9<br>Pump Controller: 11-19<br>Meter: 21-29<br>Inverter: 31-39<br>String Combiner Box: 41-49 |
| **"MTDET1":30012302,** | Meter Detail |
| **"POTP":"34123450",** | **Previous One Time Password** |
| **"COTP":"34123450",** | **Current One Time Password** |
| **"MTBLDATE1":18,** | Billing Date for meter 1 |
| **"DATE1":180606,** | Present date for meter1 |
| **"TIME1":105400,** | Present time for meter1 |
| **"IR1":20.58,** | R Phase Current in Amps |
| **"IY1":20.65,** | Y Phase Current in Amps |
| **"IB1":20.12,** | B Phase Current in Amps |
| **"VRN1":240.12,** | R Phase to Neutral Voltage in Volts |

| | |
|---|---|
| **"VYN1":242.13,** | Y Phase to Neutral Voltage in Volts |
| **"VBN1":243.55,** | B Phase to Neutral Voltage in Volts |
| **"VRY1":420.18,** | Phase to Phase Voltage(R-Y) in Volts |
| **"VYB1":419.38,** | Phase to Phase Voltage(Y-B) in Volts |
| **"VBR1": 421.5,** | Phase to Phase Voltage(B-R) in Volts |
| **"PFR1":0.98,** | R Phase Power Factor |
| **"PFY1":0.97,** | Y Phase Power Factor |
| **"PFB1":0.96,** | B Phase Power Factor |
| **"FRQ1":50.05,** | Grid Frequency |
| **"POWR1":42.578,** | R Phase Active Power in KW |
| **"POWY1":42.156,** | Y Phase Active Power in KW |
| **"POWB1":42.354,** | B Phase Active Power in KW |
| **"POW1":42.185,** | Total Active Power in KW |
| **"RPOWR1":22.123,** | R Phase Reactive Power in KVAR |
| **"RPOWY1":20.110,** | Y Phase Reactive Power in KVAR |
| **"RPOWB1":22.310,** | B Phase Reactive Power in KVAR |
| **"RPOW1":65.610,** | Total Reactive Power in KVAR |
| **"APOWR1":55.610,** | R Phase Apparent Power in KVA |
| **"APOWY1":52.910,** | Y Phase Apparent Power in KVA |
| **"APOWB1":53.911,** | B Phase Apparent Power in KVA |
| **"APOW1":14.198,** | Total Apparent Power in KVA |
| **"KWHNET1":98561.4,** | Cumulative Net Energy in KWH |
| **"KWHIMP1":98561.4,** | Cumulative Import Energy in KWH |
| **"KWHEXP1":98561.2,** | Cumulative Export Energy in KWH |
| **"KVAHNET1":99100.3,** | Cumulative Net Energy in KVAH |
| **"KVAHIMP1":99105.1,** | Cumulative Import Energy in KWH |
| **"KVAHEXP1":98999.1,** | Cumulative Export Energy in KWH |
| **"MDKWIMP1":100.3,** | Rising Demand (Import) in KW |
| **"MDKWEXP1":98.6,** | Rising Demand (Export) in KW |
| **"POFF1":1020,** | Grid Power Failure in Minutes |
| **"TC1":100,** | Total Tamper Counts |
| **"PF1":0.99,** | Average PF |
| **"LBKWHNET1":98561,** | Last Billing Cycle Net Energy in KWH |
| **"LBKWHIMP1":98561,** | Last Billing Cycle Import Energy in KWH |
| **"LBKWHEXP1":98561,** | Last Billing Cycle Export Energy in KWH |
| **"PMDKVAIMP1":22.50,** | Present MD KVA Import |
| **"PMDKVAEXP1":0.00,** | Present MD KVA Import |
| **"LBMDKWIMP1":7.07,** | Last Billing MD KW Import |
| **"LBMDKWEXP1":0.00,** | Last Billing MD KW Export |
| **"LBMDKVAIMP1":7.07,** | Last Billing MD KVA Import |
| **"LBMDKVAEXP1":0.00,** | Last Billing MD KVA Export |
| **"MDRSTC1":4** | MD Reset Count |
| | |
| **}** | |

| **Reaction** | |
|---|---|
| **Not Applicable** | |

## Communication Format Annexure

## Annexure – 3 Inverter

Message Name : Inverter Periodic Push (INVERTER-1)
Message Format : JSON
Message Type : Data
Message Command Flow : Not Applicable for Data periodic Push
Message response Flow : RMS -> State SWPS IoT Platform
Message Medium : GPRS

| Command Message | |
|---|---|
| | |
| **Not Applicable** | |

| Response Message | |
|---|---|
| **Message** | **Description** |
| **{** | |
| **"VD":5** | Virtual Device Index/Group |
| **"TIMESTAMP":"2020-05-18 17:58:00",** | RTC timestamp of RMS/DCU against all parameters of vd/group |
| **"MAXINDEX":96** | maximum index of local storage date |
| **"INDEX":7,** | reference of local storage |
| **"LOAD":0,** | Local storage retrieval command & status |
| **"STINTERVAL":15,** | Periodic interval at which RMS shall store and transmit data to server. (in minutes) |
| **"MSGID":"",** | Message Transaction Id - required for "Ondemand"/"Config" message type, request/response/acknowledgement/feedback |
| **"DATE":200518,** | local storage date |
| **"IMEI":"1234561234561234",** | IMEI No. of First Sim to be considered always for unique identity of DCU |
| **"ASN_31":"34123450",** | **Inverter Serial No.**<br>RMS: 0<br>DAQ: 1-9<br>Pump Controller: 11-19<br>Meter: 21-29<br>Inverter: 31-39<br>String Combiner Box: 41-49 |
| **"POTP":"34123450",** | **Previous One Time Password** |
| **"COTP":"34123450",** | **Current One Time Password** |
| **"IST1":1,** | **Inverter Status** |
| **"IFREQ1":40,** | **Frequency** |
| **"IPF1":0.8,** | **Power Factor** |
| **"IDC1V1":500,** | **DC-1 Voltage** |
| **"IDC1I1":200,** | **DC-1 Current** |
| **"IDC1KW1":200,** | **DC-1 Power** |
| **"IDC2V1":243.55,** | **DC-2 Voltage** |

| | |
|---|---|
| "IDC2I1":420.18, | DC-2 Current |
| "IDC2KW1":200, | DC-2 Power |
| "IDC3V1":419.38, | DC-3 Voltage |
| "IDC3I1":421.8, | DC-3 Current |
| "IDC3KW1":200, | DC-3 Power |
| "IDC4V1":0.98, | DC-4 Voltage |
| "IDC4I1":0.97, | DC-4 Current |
| "IDC4KW1":200, | DC-4 Power |
| "IRPHV1":0.96, | R phase voltage |
| "IRPHI1":50.05, | R phase current |
| "IRPHKW1":50.05, | R phase Active Power |
| "IYPHV1":42.578, | Y phase voltage |
| "IYPHI1":42.156, | Y phase current |
| "IYPHKW1":50.05, | Y phase Active Power |
| "IBPHV1":42.354, | B phase voltage |
| "IBPHI1":42.185, | B phase current |
| "IBPHKW1":50.05, | B phase Active Power |
| "IKW1":22.123, | Active Power |
| "ITKWH1":20.110, | Today Generated Energy |
| "ITON1":22.310, | Today On Time of Inverter |
| "ILKWH1":65.610, | Life time Generated Energy |
| "ILON1":55.610, | Life time running hours |
| "ITEMP1":52.910, | Inverter Temperature |
| "IFT11":53.911, | Fault-1 |
| "IFT21":14.198, | Fault-2 |
| "IFT31":98561.4, | Fault-3 |
| "IFT41":98561.4, | Fault-4 |
| "IFT51":98561.2, | Fault-5 |
| "IKVA1":99100.3, | Apparent power |
| "IKVAR1":99105.1 | Reactive power |
| } | |

| Reaction | |
|---|---|
| | |
| Not Applicable | |

Communication Format Annexure

Annexure - 4 String Combiner Box

Message Name : Periodic Push String Combiner Box
Message Format : JSON
Message Type : Data
Message Command Flow : Not Applicable for Data periodic Push
Message response Flow : RMS -> State SWPS IoT Platform
Message Medium : GPRS

| Command Message | |
|---|---|
| | |
| **Not Applicable** | |

| Response Message | |
|---|---|
| **Message** | **Description** |
| **{** | |
| **"VD":9** | Virtual Device Index/Group |
| **"TIMESTAMP":"2020-05-18 17:58:00",** | RTC timestamp of RMS/DCU against all parameters of vd/group |
| **“MAXINDEX”:96** | maximum index of local storage date |
| **"INDEX":7,** | reference of local storage |
| **"LOAD":0,** | Local storage retrieval command & status |
| **"STINTERVAL":15,** | Periodic interval at which RMS shall store and transmit data to server. (in minutes) |
| **"MSGID":"",** | Message Transaction Id - required for “Ondemand”/”Config” message type, request/response/acknowledgement/feedback |
| **"DATE":200518,** | local storage date |
| **"IMEI":"1234561234561234",** | IMEI No. of First Sim to be considered always for unique identity of DCU |
| **"ASN_41":"34123450",** | **SJB Serial no**<br>RMS: 0<br>DAQ: 1-9<br>Pump Controller: 11-19<br>Meter: 21-29<br>Inverter: 31-39<br>String Combiner Box: 41-49 |
| **"POTP":"34123450",** | **Previous One Time Password** |
| **"COTP":"34123450",** | **Current One Time Password** |
| **"SI11":"3.00",** | **SJB1, Channel1 Current** |
| **"SI21":"5.00",** | **SJB1, Channel2 Current** |
| **"SI31":"5.00",** | **SJB1, Channel3 Current** |
| **"SI41":"5.00",** | **SJB1, Channel4 Current** |
| **"SI51":"5.00",** | **SJB1, Channel5 Current** |

| | |
|---|---|
| "SI61":"5.00", | SJB1, Channel6 Current |
| "SI71":"5.00", | SJB1, Channel7 Current |
| "SI81":"5.00", | SJB1, Channel8 Current |
| "SI91":"5.00", | SJB1, Channel9 Current |
| "SI101":"5.00", | SJB1, Channel10 Current |
| "SI111":"5.00", | SJB1, Channel11 Current |
| "SI121":"5.00", | SJB1, Channel12 Current |
| "SI131":"5.00", | SJB1, Channel13 Current |
| "SI141":"5.00", | SJB1, Channel14 Current |
| "SI151":"5.00", | SJB1, Channel15 Current |
| "SI161":"5.00", | SJB1, Channel16 Current |
| "SI171":"5.00", | SJB1, Channel17 Current |
| "SI181":"5.00", | SJB1, Channel18 Current |
| "SI191":"5.00", | SJB1, Channel19 Current |
| "SI201":"5.00", | SJB1, Channel20 Current |
| "SI211":"5.00", | SJB1, Channel21 Current |
| "SI221":"5.00", | SJB1, Channel22 Current |
| "SI231":"5.00", | SJB1, Channel23 Current |
| "SI241":"5.00", | SJB1, Channel24 Current |
| "SDCV1":"635.00", | SJB1, DC Voltage |
| "SDCTOTI1":"40.00", | SJB1, Total DC Current |
| "SDCTOTKW1":"28.00", | SJB1, Total DC Power |
| "SDI11":"1.00", | SJB1, Digital Input1 |
| "SDI21":"1.00", | SJB1, Digital Input2 |
| "ST11":"1.00", | SJB1, Temperature1 |
| "ST21":"1.00", | SJB1, Temperature2 |
| "ST31":"1.00" | SJB1, Temperature3 |
| } | |
| | |

| Reaction | |
|---|---|
| | |
| Not Applicable | |

Communication Format Annexure

Annexure – 5 RMS

Message Name : RMS
Message Format : JSON
Message Type : Heartbeat
Message Command Flow : Not Applicable
Message response Flow : RMS -> State SWPS IoT Platform
Message Medium : GPRS

| Command Message | |
|---|---|
| | |
| **Not Applicable** | |

| Response Message | |
|---|---|
| **Message** | **Description** |
| **{** | |
| **"VD":0** | Virtual Device Index/Group |
| **"TIMESTAMP":"2020-05-18 17:58:00",** | RTC timestamp of RMS/DCU against all parameters of vd/group |
| **“MAXINDEX”:96** | maximum index of local storage date |
| **"INDEX":7,** | reference of local storage |
| **"LOAD":0,** | Local storage retrieval command & status |
| **"STINTERVAL":15,** | Periodic interval at which RMS shall store and transmit data to server. (in minutes) |
| **"MSGID":"",** | Message Transaction Id - required for “Ondemand”/”Config” message type, request/response/acknowledgement/feedback |
| **"DATE":200518,** | local storage date |
| **"IMEI":"1234561234561234",** | IMEI No. of First Sim to be considered always for unique identity of DCU |
| **"POTP":"341234",** | **Previous One Time Password** |
| **"COTP":"341234",** | **Current One Time Password** |
| **"GSM":1,** | Device connected to GSM network |
| **"SIM":1,** | SIM detected (1 - detected) |
| **"NET":1,** | Device in Network (1 - in network) |
| **"GPRS":"1",** | GPRS connected (1 - connected) |
| **"RSSI":22,** | Signal Strength |
| **"SD":"1",** | SD card detected (1 - detected) |
| **"ONLINE":1,** | Device Online (1- Online) |
| **“GPS”:1,** | GPS Module Status (1-ON,0-OFF) |
| **“GPSLOC”:1,** | GPS Location Locked |
| **“RF”:1,** | RF Module Status (1-ON,0-OFF) |
| **"RTCDATE":180918,** | RTC Date |
| **"RTCTIME":175800,** | RTC Time |
| **“TEMP”:45.5,** | Device Temperature |

| | |
|---|---|
| **“LAT”:19.06,** | Latitude from gps |
| **“LONG”:72.8777,** | Longitude from gps |
| **“SIMSLOT”:1,** | Sim Slot (Current Sim Slot: 1 or 2) |
| **“SIMCHNGCNT”:10,** | Total Sim Slot Change Count |
| **“FLASH”:1,** | Device Flash Status 1: Detected 0: Error |
| **“BATTST”:0,** | Battery Input Status: 1 if on battery power else 0 |
| **“VBATT”:5.0,** | Battery Voltage |
| **“PST”:1** | Power Supply (1-Mains, 2-Battery) |
| **}** | |
| | |

| **Reaction** | |
|---|---|
| | |
| **Not Applicable** | |

## Annexure – 6 DAQ System

| | |
|---|---|
| Message Name | : Periodic Push DAQ System |
| Message Format | : JSON |
| Message Type | : Data |
| Message Command Flow | : Not Applicable for Data periodic Push |
| Message response Flow | : RMS -> State SWPS IoT Platform |
| Message Medium | : GPRS |

| **Command Message** | |
|---|---|
| **Not Applicable** | |

| **Response Message** | |
|---|---|
| **Message** | **Description** |
| **{** | |
| **"VD":12** | Virtual Device Index/Group |
| **"TIMESTAMP":"2020-05-18 17:58:00",** | RTC timestamp of RMS/DCU against all parameters of vd/group |
| **“MAXINDEX”:96** | maximum index of local storage date |
| **"INDEX":7,** | reference of local storage |
| **"LOAD":0,** | Local storage retrieval command & status |
| **"STINTERVAL":15,** | Periodic interval at which RMS shall store and transmit data to server. (in minutes) |
| **"MSGID":"",** | Message Transaction Id - required for “Ondemand”/”Config” message type, request/response/acknowledgement/feedback |
| **"DATE":200518,** | local storage date |
| **"IMEI":"1234561234561234",** | IMEI No. of First Sim to be considered always for unique identity of DCU |
| **"POTP":"34123450",** | **Previous One Time Password** |
| **"COTP":"34123450",** | **Current One Time Password** |
| **“AI11”:45.5,** | Analog Input – 1 |
| **“AI21”:45.5,** | Analog Input – 2 |
| **“AI31”:45.5,** | Analog Input – 3 |
| **“AI41”:45.5,** | Analog Input – 4 |
| **“DI11”:1,** | Digital Input – 1 |
| **“DI21”:0,** | Digital Input – 2 |
| **“DI31”:1,** | Digital Input – 3 |
| **“DI41”:0,** | Digital Input – 4 |
| **“DO11”:1,** | Digital Output – 1 |
| **“DO21”:1,** | Digital Output – 2 |
| **“DO31”:1,** | Digital Output – 3 |
| **“DO41”:1** | Digital Output – 4 |
| **}** | |

| **Reaction** | |
|---|---|
| **Not Applicable** | |

## Annexure – 7

Message Name : On Demand Read/Write Parameter/Keyword
Message Format : JSON
Message Type : Config
Message Command Flow : Cloud Server-> RMS
Message Response Flow : RMS -> Cloud Server
Message Medium : GPRS

| Command Message | |
|---|---|
| **Message** | **Description** |
| **{** | |
| **"timestamp":"2018-09-18 17:58:00",** | |
| **"type": "config",** | |
| **"cmd":"write",** | To write config |
| **"msgid":"130",** | Server Auto Generated |
| **"APN1": "www"** | APN Value for sim1 |
| **"USR1": "string"** | sim1 user name |
| **"PASS1": "string"** | sim1 password |
| **"APN2": "Internet"** | APN Value for sim2 |
| **"USR2": "string"** | Sim2 user name |
| **"PASS2": "string"** | Sim2 password |
| **"RESTART":1** | To restart DCU, 1 : Execute command |
| **"UPDATEINTERVAL":15** | Enter update interval in mins. |
| **"HEARTINTERVAL":5** | Heartbeat Update Interval in mins |
| **"URTCDATE":200622** | DCU RTC Date (YYMMDD) Update |
| **"URTCTIME":220312** | DCU RTC Time (HH:MM:SS) Update - 24 hour format |
| **"UPDATERTC":1** | Update RTC, 1: Execute command, 0 : Successful execution |
| **"GSMSYNC":1** | RTC auto GSM synchronization, 1: to execute command |
| **"DO1":1** | Pump Remote ON/OFF Operation (1-ON, 0-OFF) |
| **"AI1ZERO":1** | Engineering Zero Value (4 mA dc) for AI1<br>E.G. 0(LPM) |

| | |
|---|---|
| **"AI1SPAN":100** | Engineering Span Value (20 mA dc) for AI1<br>E.G. 5000(LPM) |
| **"AI2ZERO":1** | Engineering Zero Value (4 mA dc) for AI2 |
| **"AI2SPAN":100** | Engineering Span Value (20 mA dc) for AI2 |
| **"AI3ZERO":1** | Engineering Zero Value (4 mA dc) for AI3 |
| **"AI3SPAN":100** | Engineering Span Value (20 mA dc) for AI3 |
| **"AI4ZERO":1** | Engineering Zero Value (4 mA dc) for AI4 |
| **"AI4SPAN":100** | Engineering Span Value (20 mA dc) for AI4 |
| **"URL":"rms1.kusumiiot.co"** | URL of Broker Server |
| **"PORT":8883** | Port of Broker Server |
| **"CID":"d:860906045525646$standalonesolarpump$27"** | Unique Client id of device |
| **"USERNAME":"860906045525646$standalonesolarpump$27"** | Username for device authentication |
| **"PASSWORD":"9e0baa73"** | Password for device authentication |
| **"FTPURL": "rms1.kusumiiot.co"** | URL for FTP |
| **"FTPUSER":"866191037709301"** | Username for FTP |
| **"FTPPASS":"908552f"** | Password for FTP |
| **"FTPPORT":22** | Port for FTP |
| **"FTPDOWN":1** | Download Certificates from ftp<br>1: To execute command,<br>0: Command is successfully executed |
| **}** | |

| **Response Message** | |
|---|---|
| **Message** | **Description** |
| **{** | |
| **"timestamp":"2018-09-18 17:58:00",** | |

| | |
|---|---|
| **"type": "config",** | |
| **"cmd":"write",** | To write config |
| **"msgid":"130",** | Server Auto Generated |
| **"APN1": "www"** | APN Value for sim1 |
| **"USR1": "string"** | sim1 username |
| **"PASS1": "string"** | sim1 password |
| **"APN2": "Internet"** | APN Value for sim2 |
| **"USR2": "string"** | Sim2 username |
| **"PASS2": "string"** | Sim2 password |
| **"RESTART":1** | To restart DCU, 1: Execute command |
| **"UPDATEINTERVAL":15** | Enter update interval in mins. |
| **"HEARTINTERVAL":5** | Heartbeat Update Interval in mins |
| **"URTCDATE":200622** | DCU RTC Date (YYMMDD) Update |
| **"URTCTIME":220312** | DCU RTC Time (HH:MM: SS) Update - 24 hour format |
| **"UPDATERTC":1** | Update RTC, 1: Execute command, 0 : Successful execution |
| **"GSMSYNC":1** | RTC auto GSM synchronization, 1: to execute command |
| **"DO1":1** | Pump Remote ON/OFF Operation (1-ON, 0-OFF) |
| **"AI1ZERO":1** | Engineering Zero Value (4 mA dc) for AI1<br>E.G. 0(LPM) |
| **"AI1SPAN":100** | Engineering Span Value (20 mA dc) for AI1<br>E.G. 5000(LPM) |
| **"AI2ZERO":1** | Engineering Zero Value (4 mA dc) for AI2 |
| **"AI2SPAN":100** | Engineering Span Value (20 mA dc) for AI2 |
| **"AI3ZERO":1** | Engineering Zero Value (4 mA dc) for AI3 |

| | |
|---|---|
| **"AI3SPAN":100** | Engineering Span Value (20 mA dc) for AI3 |
| **"AI4ZERO":1** | Engineering Zero Value (4 mA dc) for AI4 |
| **"AI4SPAN":100** | Engineering Span Value (20 mA dc) for AI4 |
| **"URL":"rms1.kusumiiot.co"** | URL of Broker Server |
| **"PORT":8883** | Port of Broker Server |
| **"CID":"d:860906045525646$standalonesolarpump$27"** | Unique Client id of device |
| **"USERNAME":"860906045525646$standalonesolarpump$27"** | Username for device authentication |
| **"PASSWORD":"9e0baa73"** | Password for device authentication |
| **"FTPURL": "rms1.kusumiiot.co"** | URL for FTP |
| **"FTPUSER":"866191037709301"** | Username for FTP |
| **"FTPPASS":"908552f"** | Password for FTP |
| **"FTPPORT":22** | Port for FTP |
| **"FTPDOWN":1** | Download Certificates from ftp<br>1: To execute command,<br>0: Command is successfully executed |
| **}** | |

| **Command Message** | |
|---|---|
| | |
| **Command – B. In case, if some key in command are invalid** | |
| **Message** | **Description** |
| **{** | |
| **"timestamp":"2018-09-18 17:58:00",** | |
| **"type":"config",** | |
| **"cmd":"write",** | to write config |
| **"msgid":"130,** | server auto generated |
| **"APNN1": 2** | send value "2" |
| **"USR1": "xyz"** | send value "xyz" |
| **}** | |

| Response Message | |
|---|---|
| **Message** | **Description** |
| **{** | |
| **"timestamp":"2018-09-18 17:58:00",** | |
| **"type": "config",** | |
| **"cmd":"write",** | to write config |
| **"msgid":"130",** | server auto generated |
| **"APNN1": 0** | invalid Key, value will be returned '0' |
| **"USR1": "xyz"** | actual value received |
| **}** | |

| Reaction | |
|---|---|
| | |
| **Not Applicable** | |